Attitude Surveys, Transit Planning, and Automobile-Use Constraints

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This paper summarizes the procedures, findings, and implications of an attitudinal survey of existing and potential transit users. Employees at workplaces having different levels of transit accessibility and different industry classifications were sampled about (a) the characteristics of a desirable transit service, and (b) the conditions under which they would use such a service. The approach used here appears to be more cost-effective and more accurate than the traditional home interview or bus-rider attitude and market-research studies and was useful in market segmentation for transit-system planning purposes. Radical differences were found between transit users and nonusers in regard to acceptable transit-service levels. Even with a level of service acceptable to nonusers of transit, most automobile drivers conditioned a change of regular modes of travel to work on motor-fuel supply restraints.

This paper presents the results of a survey of employee attitudes and expectations undertaken as a part of the Greater New Haven Transit Study. It sets forth the objectives, procedures, findings, and transit planning implications obtained from employee attitude surveys at five locations (1). It shows how the present modal choice is related to transit-service planning features and how automobile-use constraints would affect transit use and planning.

SURVEY DESIGN AND OBJECTIVES

Previous studies have indicated that the best single potential for diversion of trips from automobiles to transit is the journey to work. The Greater New Haven Transit Study therefore featured employer surveys for trip data and attitudes, which were supplemented by visitor surveys for trip data at a number of major trip generators.

Survey Objectives

The objectives of the survey were

1. To produce data useful for expanding or restructuring the existing bus services,
2. To aid in developing patronage and revenue forecasts, and
3. To aid in assessing the impact of the transportation-management proposals under study by the staff of the Connecticut Department of Environmental Protection.

Minimizing Noncommitment Responses

Previous studies have found that transit attitude survey responses may be highly misleading, particularly in home interview surveys where respondents may give socially acceptable answers rather than their personal feelings on the subject (2). Also, respondents may be unfamiliar with the characteristics of the proposed transit system on which they are being asked to indicate their attitudes. This problem of potential noncommitment response may be solved by asking them about their willingness to ride public transport modes with which they have experience, and factoring down (or up) to existing ridership as a control value (3).

Accordingly, the attitude surveys used the following innovative techniques to obtain realistic responses:

1. A secret ballot survey with no interviewer participation,
2. A request that the respondents describe an acceptable transit system in terms of major operating parameters, and
3. A question as to how often and under what circumstances the respondents would use their acceptable transit system for work access.

Questionnaire Design

The employee survey questionnaire was designed so that it could be readily understood by recipients, require a minimum of time to complete, and be largely self-coding. The forms were intensively reviewed by participating agency personnel and were pretested for comprehension and completion time. The following information was requested, of which the first seven items were in both the employee and the attitude surveys:

1. Residence location,
2. Mode of access (multimode if applicable),
3. Working hours (for service planning),
4. Number of automobiles owned in the household,
5. Personal automobile (a question intended to identify priority for vehicle use),
6. Travel during the day (e.g., on lunch hour),
7. Age and sex,
8. Perceived cost of trip,
9. Longest acceptable walking distance,
10. Longest acceptable waiting time,
11. Longest acceptable journey-to-work time (door-to-door),
12. Maximum acceptable time difference between bus and transit (diversion curve data),
13. Highest acceptable fare,
14. Bad weather shelter impact,
15. Impact of standing load on bus, and
16. Circumstances of bus use.

Sampling Procedures

Surveys of employee attitudes toward public transportation were undertaken at five locations. Approximately 5800 employees were included in the attitude survey population. The sites surveyed included a major downtown office building housing law firms and such, a telephone company office building, industrial management offices on the fringe of downtown, a suburban college, and South Central Connecticut State College in New Haven. (All of the employers were cooperative and helpful in distributing and collecting the survey questionnaires.) Return rates ranged from 25 to 100 percent and averaged 46 percent.

Survey forms were distributed through the personnel and accounting sections of participating firms. To avoid bias in the distribution of forms, each firm was instructed to conduct a 100 percent sample of its employees and was given sufficient forms for this purpose. The forms were sampled on a random basis to provide a minimum of 200 acceptable coded responses/employer, or where the number of sample returns was less than 200, all were coded. The sample sizes for the employee and attitude surveys were 3237 and 960 respectively, which were sufficient to provide good statistical reliability.

Table 1. Profile of transit commuters.

Characteristic	Workers Who Use Transit (%)		
	Downtown	Outlying[a]	Region
Have personal automobile	57.0	29.2	44.6
Two or more automobiles in household	41.8	14.2	25.1
One automobile in household	43.9	36.1	40.4
No automobile in household	14.3	49.7	30.1
Female	77.5	73.8	75.5
Male	22.5	26.2	24.5
Under 18 years of age	3.1	0.5	1.9
18 to 35 years of age	40.2	32.1	36.4
36 to 54 years of age	38.0	39.3	38.6
55 years of age or more	18.6	28.1	23.1
Workplace location	55.2	44.8	100.0

Notes: Sample size and employment represented are 793 and 4455, 2444 and 15 318, and 3237 and 19 773 for the downtown, outlying, and overall regions respectively.
Percentages are based on samples expanded to total employment at each location surveyed.

[a] Includes downtown New Haven frame, viz., Yale-New Haven Hospital and Penn Central Railroad offices, and outlying survey locations.

Table 2. Attitude survey findings.

Characteristic	Acceptable Standard[a]	Respondents[b] (%)		
		Transit	Automobile Driver	All
Walking distance (time)	2 blocks (3 min)	73	68	69
	300 m (5 min)	45	31	30
Waiting time	5 min	84	86	87
	10 min	44	33	36
Total fare	25 cents	94	74	78
	35 cents	74	48	53
	Free fare essential	4	6	6
Time difference (assuming transit longer)	5 min	86	77	79
	10 min	59	42	43
	15 min	41	12	16
Bus shelter	Provided at each stop	17	58	49
Standing on bus	Up to 5 or 10 min	70	59	62

Notes: 1 m = 3.3 ft.
Number of respondents and employment represented are 112 and 754, 584 and 3358, and 960 and 5806 for the transit user, automobile driver, and all populations respectively

[a] Standard desired by indicated percentages of respondents.
[b] Accepting this level of service or better.

SURVEY FINDINGS

The employer survey found that a larger portion of the workers who use transit in Greater New Haven do so by choice than is the case in other areas. Transit users comprised 23.9, 4.1, and 8.8 percent of all workers in the downtown, outlying, and overall regions respectively. The characteristics of these transit users are given in Table 1. About 42 percent of the downtown workers who used transit and 14 percent of the nondowntown (downtown frame and outlying workplaces combined) transit users had two or more automobiles in their households. A personal automobile for use as needed was reported by 57 percent of downtown transit commuters (core only) and 29 percent of the others. Generally, transit surveys find that only about 15 percent of transit riders have both a driving license and an automobile available for their transit trip. Outlying and downtown frame employees were more likely to be transit dependent in that about half (49.7 percent) had no automobile in their family or household. They represent a more typical situation.

Women predominated among transit commuters (about 75 percent) in both downtown and outlying locations. This proportion (70 to 75 percent female) is typical of local public transportation in the United States. There was no apparent relation between transit use and the age of the rider.

The dominance of downtown New Haven as a bus-traffic generator was confirmed by the surveys. Approximately 24 percent of downtown New Haven employees used transit for access to work. In contrast, bus use by central business district (CBD) frame employees (i.e., those at Yale-New Haven Hospital and the Penn Central Railroad offices) was about 14 percent, and only 2.7 percent of employees working away from the CBD used transit to get to work.

User and Nonuser Expectations

Selected characteristics of an acceptable transit system, as reported by the attitude surveys, are summarized in Table 2. Transit-rider and automobile-driver responses are identified separately.

1. Walking distance or time—Automobile drivers and transit riders were similar in walking-distance tolerance. About 70 percent of each population group was willing to walk more than 2 blocks to a bus stop. Less than half of each were willing to walk more than 5 min (300 to 400 m; 1000 to 1300 ft). These data confirm the distance tolerance assumption used in estimating the population coverage of bus routes (300 m; 1000 ft).
2. Waiting time—Waiting time preferences were also similar for transit users and automobile drivers. About 85 percent of both groups would wait 5 min for a bus, but less than half would wait 10 min or more.
3. Fares—User charges for bus service were accepted by a consensus of the population. Only 6 percent of the survey respondents would ride buses only if there was no fare charge. Over 90 percent of the bus riders and over 70 percent of the automobile drivers would accept a 25-cent fare. (This represents a survey of the working population. Senior citizens and student populations are more sensitive to fares.) Over 70 percent of transit riders and over 50 percent of all respondents accepted the Connecticut Company basic fare of 35 cents. Automobile drivers were apparently more sensitive to fares than are present transit users. Less than half of the automobile drivers indicated that they would pay a 35-cent fare. This response implies that a fare reduction would increase system deficits, since a radical increase in service levels, as well as a fare reduction, would be necessary to attract motorists to transit.
4. Time difference—The higher transit service expectations of automobile drivers were reflected in the greater acceptance of longer transit travel time by transit users. Only about 40 percent of the automobile drivers would accept an extra 10 min of travel time by public transportation. For a typical 6-km (3.6-mile) trip at a realistic bus speed of 16 to 20 km/h (10 to 12 mph), the average trip may require about 20 min, and the door-to-door time (including walking and waiting) will be approximately 35 min, if bus service is frequent and direct. Automobile travel time for the same trip might be about 12 min, and the door-to-door (including parking and terminal) times approximately 20 min. Such a 15-min time difference would be accepted by fewer than 20 percent of the surveyed automobile drivers.

Transit users were more tolerant of time differences, possibly because many did not have the alternative of travel by automobile. Almost 60 percent would accept a trip time 10 min longer than that by automobile, and over 40 percent would accept a 15-min time difference. If people do not have private transport alternatives, the maximum acceptable transit travel times or fares limit their choices of housing and employment. Comparisons

Table 3. Projected use of acceptable bus system.

Projected Bus Use Frequency[a]	Respondents (%) Transit	Automobile Driver	All
Daily instead of driving	87	39	45
Occasional use such as tune-up	0	12	9
Constrained use (gasoline $0.25/L or rationed, parking surcharge of $1.00, or combination thereof)	12	46	41
Unlikely (no answer to question on form)	1	3	5
Total	100	100	100

Notes: 1 L = approximately 0.25 gal. (English units were used in the original survey data.) Number of respondents and employment represented are 112 and 754, 584 and 3358, and 960 and 5806 for the transit user, automobile driver, and all populations respectively.

[a] Assuming a bus service with the desired walking distance, waiting time, speed, and such is provided.

Table 4. Impact of constraints on automobile use.

Constraint	Automobile Drivers Taking Bus[a] Number	Percent
Gasoline cost of $0.25/L or more	40	24.3
Gasoline rationed to 40 L/week	20	12.1
Gasoline rationed and cost of $0.25/L or more	50	30.3
Subtotal gasoline-related	110	66.7
Parking cost increased by $1.00	1	0.6
Free bus and parking cost increased	13	7.9
Gasoline cost of $0.25/L or more and parking cost increased $1.00	9	5.4
Gasoline rationed, cost of $0.25/L or more, and parking cost increased by $1.00	15	9.1
Gasoline rationed and parking cost increased by $1.00	4	2.4
Gasoline rationed or cost of $0.25/L or more, parking cost increased by $1.00, and bus ride free	13	7.9
Subtotal parking-related	55	33.3
Total	165	100.0

Note: 1 L = approximately 0.25 gal.

[a] Unexpanded responses, all locations combined, constrained mode change by automobile drivers only.

with private automobile travel time are of limited significance for these riders because total trip times constrain their transit use.

5. Bus shelters—The difference in expectations between the present transit user and the automobile driver was particularly delineated by their attitude on shelters. Only 17 percent of the transit users indicated a need for a bus shelter at their stop. Over half of the automobile drivers would use a bus in bad weather only if a shelter were available.

6. Standing on the bus—About 70 percent of the transit riders were willing to stand for 5 or 10 min on their bus trips. A smaller majority of automobile drivers (59 percent) were also willing to stand for this time on each trip. These attitudes are consistent with observed passenger behavior in peak hours at maximum load points.

Potential System Use

The attitude surveys also attempted to identify potential users of the transit system, assuming that a service that meets level-of-service expectations could be provided. Table 3 summarizes the projected use of an acceptable (i.e., custom-designed) bus system by the survey respondents.

Of present transit users, 87 percent would use a bus system that meets their specifications. (The other 13 percent may represent errors in the data or responses from motorists who were using buses because of temporary automobile unavailability.)

A majority of present automobile drivers would normally continue to drive even if an acceptable bus system were available to them. This response is consistent with driver behavior observed during the energy crisis of 1973-74. Even so, the diversion to transit of the 39 percent who would change their travel mode could represent an increase of approximately 88 percent in downtown transit trips. (A radical improvement in transit service would be necessary on most routes to achieve this level of use.)

Transit Planning Implications

The attitude surveys imply that potential transit consumers who now use automobiles would accept a bus system with the following features: (a) routes 4 blocks apart at most; (b) short headways, ideally as short as 5 min in peak hours; (c) a basic zone fare of 25 cents; (d) travel times no more than 10 min longer than by automobile; (e) shelters at almost all bus stops; and (f) seats for all passengers, except on the last 5 or 10 min of heavily used local runs.

These features describe a marketable public transportation product. They provide planning objectives for service improvements, even though they may not be economically realistic in terms of potential revenues, public funding resources, and geographic or development factors or both.

1. Route spacing—Routes can feasibly be spaced at 4-block intervals in an urban area with a gross population density approaching 3900 persons/km^2 (10 000 persons/mile^2), a condition that is met by most of New Haven. Suburban areas with population densities of approximately 800 persons/km^2 (2000 persons/mile^2) cannot be fully covered by bus service although, within such areas, it may be feasible to serve a series of high-density apartments or condominium developments if they are located within 300 to 500 m (1000 to 1500 ft) of a major arterial street.

2. Fares—The dominant automobile-user preference for a 25-cent fare may reflect a desire for a convenient single-coin fare, rather than a monetary limit. This fare preference is inconsistent with known data on transit-fare elasticity and with current automobile operating costs. Successful commuter buses have been operating in the New Haven area at fares of $0.50 to $1.25/ride. The 25-cent fare may, however, be desirable for in-city shuttle service and for special promotions.

3. Travel times—If the maximum allowable time difference is 10 min, normal local bus services, with their 16 to 20-km/h (10 to 12-mph) average speeds, cannot compete with automobile trips unless the total trip time is less than 10 min. This implies a local bus-service limit of about 3.2 km (2.0 miles) when waiting and other access times are minimized. Express services, especially park-and-ride buses that operate nonstop between outlying parking facilities and the CBD, can be competitive for greater distances if the buses are given priority at locations where traffic queues form during peak hours.

Automobile-Use Constraints as Transit Incentives

Even if an acceptable transit service is provided, automobile users have a residual preference for the private automobile as a transportation mode. If public policy objectives such as improved air quality or energy conservation require diversion of automobile users to tran-

sit, strong incentives will be required.

Table 4 summarizes the impacts of various constraints to automobile use on potential bus ridership. Of the energy-environmental constraints listed in the attitude survey, the measures with the strongest impacts reflect gasoline cost or supply. Parking-related measures, with or without free bus service, had little impact on respondents' choice of mode unless coupled with a gasoline price increase or rationing.

1. Gasoline related—The most effective single public policy incentive to transit use would involve increasing the price of motor fuel to over $0.25/L ($1.00/gal) in 1975 dollars. This incentive could be implemented through a federal motor fuel tax comparable to those levied in most Western European countries. The revenue from such a tax might be used to reduce other federal taxes or might be rebated to the cities and counties where the taxes were collected, in order to reduce their property tax burdens.

Gasoline rationing that set a 40-L (10-gal)/week limit on driving would also have a strong impact on transit use. However, rationing involves many more administrative and enforcement costs than do fuel-tax measures, which can be collected from relatively small numbers of refiners and distributors.

2. Parking related—Parking surcharges were seen as much less effective than fuel taxes or rationing as incentives to transit use. An increase in parking fees of $1.00/d in 1975 was seen as influencing modal choice by less than 1 percent of the survey respondents who indicate a willingness to change mode in response to public policy measures. To be effective in diverting automobile users to transit, parking surcharges would have to be coupled with motor fuel constraints.

CONCLUSIONS

The Greater New Haven Transit Study research used a relatively simple, unsophisticated questionnaire and analysis to point the way to a public transit service with increased consumer marketability. Its methods and findings have potential application for transit service planning in medium-sized communities throughout the United States—in adapting service to tap markets, developing transportation-system management programs, and restraining automobile use.

The survey showed that existing transit riders have much lower expectations about bus service attributes than do automobile drivers. Thus, radically improved service concepts and levels will be necessary to divert motorists to transit use and may be feasible only in selected corridors. If energy, environmental, or public policy considerations require large-scale diversions of commuters to transit, then selected automobile disincentives may be necessary. Increased motor fuel taxation appears to be a more effective disincentive than parking taxes and controls, at least in medium-sized cities.

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Abridgment

Marketing Approach Using Product Diffusion Knowledge to Measure Consumer Transit Attitudes

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This paper suggests a method that can be used to develop a measuring instrument that will (a) determine specifically why shoppers do not use the urban bus system, and (b) be sufficiently sensitive to identify whether the problem is a bus system design problem or a promotion problem.

A measuring instrument that provides these capabilities could be used by transit marketing managers to more effectively allocate their resources toward the goal of increasing bus patronage. Marketing managers will always be constrained by limited resources. Consequently, they must decide how to allocate corporate funds so as to maximize the return on their investment. Transit marketing managers are expected to make trade-offs between (a) methods of removing the barriers to adoption of the bus system, (b) the capital investment required to effect their removal, and (c) the number of potential customers who would be affected by the removal. The measuring instrument should be capable of providing information on all of the items used in the trade-off except the capital investment. The instrument should be capable of identifying the barriers to adoption, of determining whether those barriers can be removed by advertising alone or whether system redesign is also required, and it should be capable of identifying the number of individuals affected by each barrier identified.